

AIP

report

MANPOWER STATISTICS DIVISION

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ENROLLMENTS AND DEGREES

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For over two decades physics departments have contributed their enrollment and degree data to this annual survey, which has the distinction of summarizing information from nearly 100% of the 747 degree-granting physics departments in the U.S. In the mid 1970's, degree-granting astronomy departments were added to this survey, and their data are shown on the last two pages of this report.

Table I classifies institutions according to the highest physics degree granted and presents recent yearly changes in those numbers of institutions. Fluctuations occur more frequently in the number of master's degree programs because they include institutions that have either very few, or no, graduate students enrolled but whose administrations have been in favor of keeping a master's degree program on the books. The gradual decline in the number of bachelor's-granting institutions is primarily the result of colleges which terminate their undergraduate physics degree programs. Former master's programs and new physics degree programs offset this decline to make it more gradual.

By making a distinction between a terminal master's degree and one granted enroute to a higher physics degree, we are

Table I. Institutions by highest physics degree offered, 1978-1984.

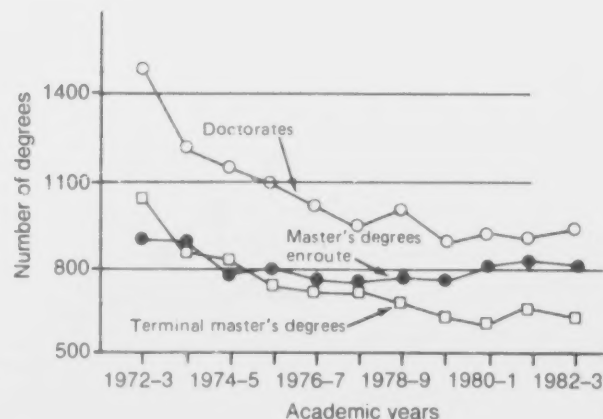
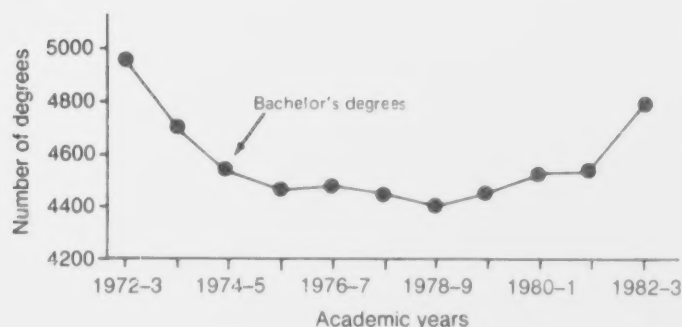
Academic year	Doctorate granting	Master's granting	Bachelor's granting
1978-79	170*	104	502
1979-80	169*	96	501
1980-81	168*	103	492
1981-82	167**	104	485
1982-83	163**	95	488
1983-84	164**	91	492

*Five of these institutions have two physics doctorate-granting departments; the second one is generally an applied physics department. They are Stanford U., U. of CA-Davis, U. of CA-San Diego, Harvard U., and Cornell U.

**Four of these institutions have two physics doctorate-granting departments. They are Stanford U., U. of CA-Davis, Harvard U., and Cornell U.

able to present four trends in degree production in **Figure I**. Of these, the bachelor's degrees show the greatest change: a 5% increase. Doctorates increased by only 1%, and both types of master's degrees declined.

Fig. I. Physics degrees awarded by academic year, 1972-83



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Table II. Physics enrollments and degrees awarded by academic year 1972-1984

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics- major enrollment		Graduate physics- student enrollment*	
	Bachelor's	Master's	Doctor's	Juniors	Seniors	Total	1st year
1972-73	4923	1961	1445	6012	5806	11 804	2904
1973-74	4652	1772	1236	5858	5108†	11 119	2680
1974-75	4571	1650	1167	5660	4253†	10 410	2668
1975-76	4487	1570	1111	5888	4922†	10 372	2646
1976-77	4517	1469	1051	5711	4930†	9 991	2624
1977-78	4457	1422	971	5820	4975††	9 835	2499
1978-79	4416	1428	1033	5835	4964	9 813	2458
1979-80	4440	1370	912	5696	4942	9 647	2439
1980-81	4513	1387	927	5905	5091	9 934	2564
1981-82	4558	1476	912	6386	5372	10 173	2637
1982-83	4795	1426	921	6299	5580	10 429	2630
1983-84				6303	5658	10 922	2855

*Includes part-time students.

†This total has been adjusted by 500 students who were seniors for more than one year.

††This total has been adjusted by 300 students who were seniors for more than one year.

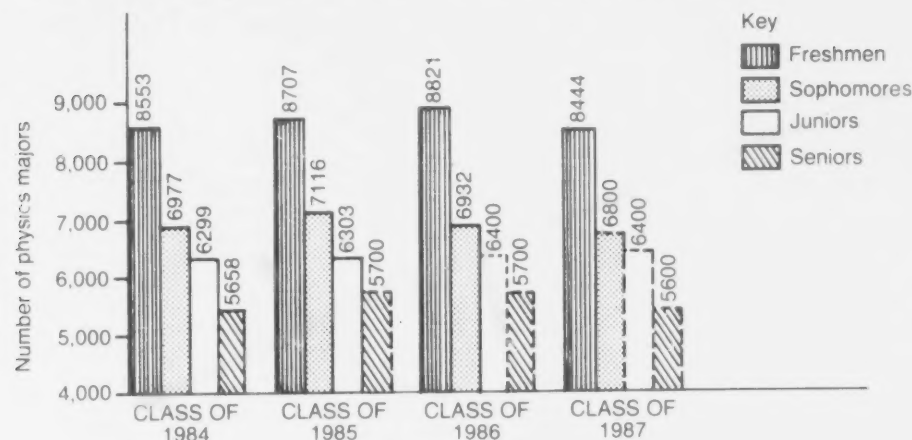
Table III. Undergraduate and graduate enrollments and degrees by institution type, 1972-1984

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics- major enrollment		Graduate physics- student enrollment*	
	Bachelor's	Master's	Doctor's	Juniors	Seniors	Total	1st year
Doctorate granting institutions							
1972-73	2265	1484	1445	2787	2717	10 227	2177
1973-74	2155	1387	1236	2844	2484	9 759	2169
1974-75	2191	1318	1167	2780	2420	9 295	2205
1975-76	2182	1249	1111	2983	2505	9 241	2163
1976-77	2184	1186	1051	2862	2502	8 867	2182
1977-78	2218	1164	971	2851	2590	8 852	2138
1978-79	2158	1183	1033	2937	2579	8 864	2107
1979-80	2142	1151	912	2696	2491	8 744	2072
1980-81	2123	1161	927	2765	2568	9 062	2223
1981-82	2179	1281	912	2996	2671	9 273	2275
1982-83	2192	1210	921	2962	2645	9 524	2288
1983-84				2955	2824	10 006	2495
Master's granting institutions							
1972-73	820	477		1145	1086	1577	727
1973-74	810	385		939	893	1360	511
1974-75	699	332		881	741	1115	463
1975-76	604	321		916	811	1131	483
1976-77	658	283		840	761	1078	442
1977-78	590	258		832	752	983	361
1978-79	541	245		795	694	949	351
1979-80	585	219		705	650	903	367
1980-81	589	226		868	655	872	341
1981-82	532	195		917	734	900	362
1982-83	554	216		877	752	905	342
1983-84				830	722	916	360
Bachelor's granting institutions							
1972-73	1838			2080	2003		
1973-74	1687			2075	1731		
1974-75	1681			1999	1748		
1975-76	1701			1989	1606		
1976-77	1675			2009	1667		
1977-78	1649			2137	1633		
1978-79	1717			2103	1691		
1979-80	1713			2295	1801		
1980-81	1801			2272	1868		
1981-82	1847			2473	1967		
1982-83	2049			2460	2183		
1983-84				2518	2112		

Geographic region†	1979-80	1980-81	1981-82	1982-83	1983-84
New England	18 797	21 766	20 228	19 124	19 147
Mid Atlantic	41 555	43 216	41 879	45 236	49 788
E. N. Central	50 843	54 663	54 430	54 410	57 721
W. N. Central	21 805	23 406	23 420	25 776	25 820
S. Atlantic	33 966	33 800	36 544	36 750	40 668
E. S. Central	14 829	15 068	16 276	14 712	15 820
W. S. Central	28 563	30 030	28 188	28 980	32 337
Mountain	20 753	21 035	23 408	25 966	27 532
Pacific	31 318	36 150	34 656	36 076	36 214
Total	262 429	279 134	279 029	287 030	305 047

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Fig. II. Actual and projected number of undergraduate physics majors



Note: Each cluster of bars shown in Figure II depict the freshmen, sophomores, juniors, and seniors of four successive graduating classes. The most recent estimate of freshman physics majors is 8444 and refers to September 1983. Based on the attrition of earlier classes 5600 of them are expected to become senior physics majors in 1986-87 and are presented above as the "class of 1987."

Undergraduate physics majors

At most institutions students are not required to declare their majors until the beginning of the junior year. However, taking into account the requirements for a physics bachelor's degree, the great majority of physics department chairpersons can estimate the numbers of freshmen and sophomores who are likely to be physics majors in their departments. The attrition rates between freshmen and seniors have been monitored closely, making it possible to project classes of senior physics majors until 1987. Thus the first set of bars in Figure II follows the 1980-81 freshman physics majors through four years of undergraduate study to become the graduating class of 1984. Last September's estimate of freshman physics majors indicated a 4% decline from the previous year, and is projected to yield 5600 seniors who will become the class of 1987.

Concentrating on the 1983-84 undergraduate physics majors, Table VI offers a detailed distribution of them both geographically and by type of degree-granting institution. The last column of this table, "Fifth-year undergraduates", consists of over 500 students who need an additional summer or term to complete their degree requirements; in some cases transfers from junior colleges cause such a delay. Thus, by separating those 582 seniors from the others, physics majors at each level are counted only once. The overall attrition between freshman and senior level is approximately 35% as indicated in Figure II. Using the totals for seniors listed in the lower portion of Table VI and comparing them with the corresponding freshman physics majors of 1980-81, we find a 25% attrition at the doctorate-granting institutions, a 40% attrition at the master's-granting institutions and a 45% attrition at the four-year colleges.

Table VI. Undergraduate physics majors by geographic region and type of institution, 1983-84.

Geographic region*	Estimated** no. of freshmen	Estimated** no. of sophomores	Number of juniors	Number of seniors	Fifth-year undergraduates
New England	733	663	605	619	23
Mid Atlantic	1 552	1 207	1 062	878	66
E. N. Central	1 309	1 039	951	867	67
W. N. Central	734	592	506	454	36
S. Atlantic	1 342	1 090	839	735	79
E. S. Central	337	307	281	211	42
W. S. Central	644	583	469	467	62
Mountain	532	455	409	468	45
Pacific	1 261	996	1 181	959	162
Total	8 444	6 932	6 303	5 658	582
Doctorate-granting inst.	3 891	3 067	2 955	2 824	273
Master's-granting inst.	1 043	891	830	722	123
Bachelor's-granting inst.	3 510	2 974	2 518	2 112	186

* See Table IV for explanation of geographic region.

**Estimates of potential physics majors made by the physics department chairpersons.

Graduate enrollment

In 1980 the total graduate physics enrollment reversed its ten-year decline and resumed an upward trend. However, the major contributors to this trend reversal were foreign students who entered the U.S. in increasing numbers to study physics. **Table VII** presents the details of this trend and shows a significant change for the most recent year. In 1983-84 the U.S. component of the first-year graduate enrollment increased by almost 12%. Foreign first-year graduate students continued to increase but at a rate slower than the one observed since the late 1970's.

Table VIII focuses on the total graduate physics student population and presents their study status. As is evident from the trends in that table, master's institutions have always enrolled a large proportion of part-time graduate students, whereas at doctoral departments part-time students have comprised less than 10% since 1975-76.

The major reason for such a large proportion of full-time graduate physics students is the availability of financial support for them. There are more assistantships for first-year graduate physics students than there are students to fill them. This favorable situation is described in **Table IX** which presents the distribution of unfilled assistantships by geographic region for

Table VII. Trend in entering U.S. and foreign graduate physics students, 1974-1984.

Academic year	No. of first-year U.S. students	Foreign students	Total	% foreign students of total
1974-75	2074	594	2668	22.3
1975-76	2095	551	2646	20.8
1976-77	1987	637	2624	24.2
1977-78	1851	648	2499	26.0
1978-79	1840	618	2458	25.2
1979-80	1700	739	2439	30.3
1980-81	1720	844	2564	32.9
1981-82	1654	983	2637	37.3
1982-83	1576	1054	2630	40.1
1983-84	1763	1092	2855	38.2

both types of graduate physics departments as recorded in September 1983. A comparison of this situation with the previous year singles out two regions in which the number of unfilled assistantships at the PhD-granting institutions have greatly increased; they are the South Atlantic and the West-South-Central regions. On the other hand, unfilled assistantships at the master's institutions declined to half of what they numbered in the previous year.

Table VIII. Full-time and part-time graduate physics enrollment by type of institution, 1974-1984.

Academic year	Total number of graduate students Institution type*						
	II			III			
	Full- time	Part- time	Sub- total	Full- time	Part- time	Sub- total	Total
1974-75	623	492	1115	8326	969	9295	10 410
1975-76	628	503	1131	8439	802	9241	10 372
1976-77	576	507	1083	8119	789	8908	9 991
1977-78	546	437	983	8174	678	8852	9 835
1978-79	468	481	949	8185	679	8864	9 813
1979-80	550	353	903	8059	685	8744	9 647
1980-81	484	388	872	8302	760	9062	9 934
1981-82	543	357	900	8555	718	9273	10 173
1982-83	566	339	905	8712	812	9524	10 429
1983-84	569	347	916	9285	721	10006	10 922

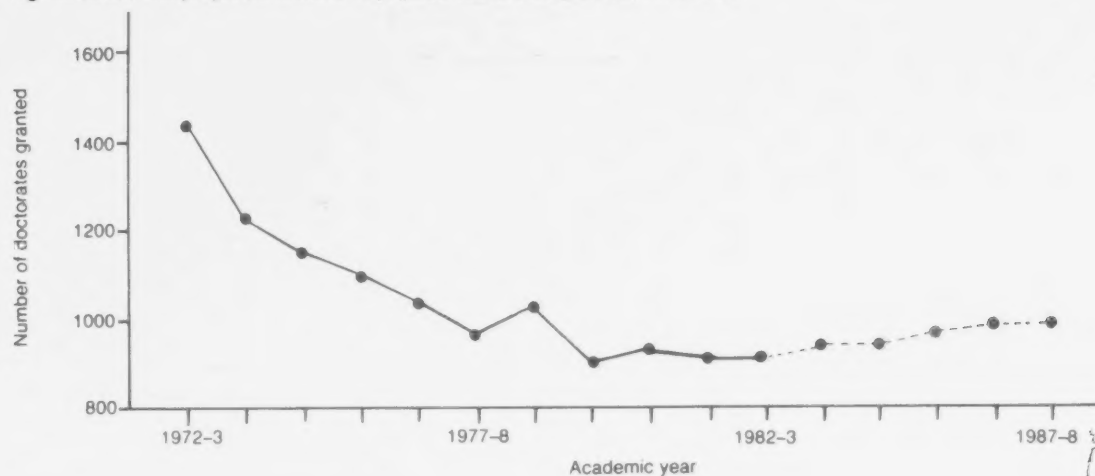
*Institution type indicates the highest physics degree offered: type II = master's degree, type III = doctorate.

Table IX. Unfilled assistantships for first-year graduate physics students, September 1983.

Geographic region*	Doctoral departments with				No. of unfilled ass'tships	No. of 1st yr. grad. students	Master's-granting depts. with			No. of unfilled ass'tships	No. of 1st yr. grad. students
	0	1-2	3-5	>6			0	1-2	3-5		
New England	16	3	0	1	16	308	4	0	0	0	12
Mid Atlantic	27	2	1	0	6	468	2	1	0	1	10
E. N. Central	19	2	0	0	3	452	19	4	0	6	103
W. N. Central	9	3	0	0	4	121	9	3	1	9	42
S. Atlantic	20	2	4	1	35	270	9	0	2	6	36
E. S. Central	8	1	0	1	9	59	3	3	0	3	35
W. S. Central	9	4	1	1	31	169	6	2	0	3	59
Mountain	11	1	2	1	26	207	3	0	0	0	14
Pacific	17	0	2	1	15	441	4	2	2	6	49
Total	136	15	10	6	145	2 495	59	15	5	34	360

*See Table IV for explanation of geographic region.

Fig. III. Actual and projected number of physics doctorates granted, 1972-1988



Degrees granted

The median number of years of graduate study required to complete a physics doctorate has hardly changed in over a decade. It is between five and six years and has a range from three to more than ten years. The high correlation between the first-year graduate students at PhD-granting institutions and the number of doctorates granted five years later is the basis for our projection presented in Figure III. In recent years, between 42% and 45% of a given year's entering graduate students complete their doctorates five years later. Since the rapid increase in foreign graduate students began less than five years ago, it is still not known what possible changes may occur in the attrition rate or to what extent the median number of years of graduate study required to complete the PhD will change. Therefore the expected number of physics doctorates to be conferred during the mid to late 1980's remains in the range of 950 to 1000 per year.

What is summarized in three rows of Table III is presented in greater detail in Table X. This table compares the contributions that three types of institutions make to the production of new physicists. Each year the smallest group of graduates is the one from master's institutions that grant master's degrees enroute to higher physics degrees. These graduates subsequently change schools. Terminal master's degrees are primarily granted by the PhD institutions rather than the master's institutions, and Table X indicates a 3:1 ratio for that degree production. Another detail shown in Table X is the geographic distribution of all the physics degrees granted in 1982-83. Here we find that in New England and the western part of the U.S., four-year colleges make a much smaller contribution to the production of physics bachelors than the same type of institution makes in the Midwest or the South Atlantic. The geographic distribution of doctorates granted in 1982-83 represents a shift away from New England and toward the mountain and Pacific regions.

Table X. Physics degrees by type of institution and geographic region, 1982-83.

Geographic region*	Bachelor's degrees			Master's degrees		Terminal master's degrees		Doctorates
	Institution type**			Institution type**		Institution type**		Institution type**
	I	II	III	II	III	II	III	III
New England	158	29	362	8	96	4	43	117
Mid. Atlantic	455	19	386	1	166	5	60	187
E. N. Central	313	168	296	17	158	41	119	171
W. N. Central	203	71	106	10	30	24	21	43
S. Atlantic	312	46	248	7	68	17	72	111
E. S. Central	98	57	72	4	8	17	12	17
W. S. Central	143	77	139	6	27	26	36	50
Mountain	81	9	190	2	44	3	39	52
Pacific	286	78	393	5	144	19	67	173
Subtotal	2 049	554	2 192	60	741	156	469	921
				801		625		
Total	4 795					1 426		921

*See Table IV for explanation of geographic region.

**Institution type indicates the highest physics degree offered: type I = bachelor's degree, type II = master's degree, type III = doctorate.

Table XI. Number of physics degrees granted by sex and minority group* status, 1982-83.

Type of degree	Sex	Total no. of degrees	Black	Am. Ind.	Puerto Rican	Mex. Am.	Hispanic	Oriental	Asian Ind.	Arab	Total minorities
Bachelor's	Men	4253	96	1	7	12	33	86	24	46	305
	Women	542	20	-	1	4	9	30	5	4	73
	Total	4795	116	1	8	16	42	116	29	50	378
Master's enroute	Men	734	13	-	-	-	12	92	20	14	151
	Women	67	1	-	-	-	1	12	6	3	23
	Total	801	14	-	-	-	13	104	26	17	174
Terminal master's	Men	561	9	-	-	1	5	28	4	6	53
	Women	64	4	-	-	-	1	4	3	2	14
	Total	625	13	-	-	1	6	32	7	8	67
Doctorate	Men	853	17	3	-	1	16	65	30	20	152
	Women	68	-	-	-	-	1	6	8	-	15
	Total	921	17	3	-	1	17	71	38	20	167

*Minorities in AIP surveys are defined as groups with a low representation in the physics community, but ones whose participation has aroused considerable interest.

Closely tied to the data we collect and analyze on foreign student enrollment in physics programs are our data on minority groups because a majority of the members are foreign citizens. We therefore define minority groups as those who have a small but noted representation among the physics degree recipients; hence it appeared appropriate to include women in **Table XI**, which focuses on physics degree recipients for the most recent academic year, 1982-83, irrespective of citizenship. The sources for this information are: (1) a report of women and minority degree recipients from physics department chairpersons, and (2) identification with minority groups by individual graduates. The second source forms part of two student surveys* conducted annually by AIP.

The exceptionally high response rate to this survey, mentioned at the beginning of this report, does not include the questions requesting minority data. For that reason one needs to view the number of minority degree recipients at all levels as lower limits. However, it should be noted that the totals in the last column of **Table XI** are greater than those of the previous year; that is especially true of the master's degrees enroute to doctorates, which doubled.

*"Survey of Physics and Astronomy Bachelor's Degree Recipients" AIP Pub. No. R-211.14.

"Graduate Student Survey" AIP Pub. No. R-207.15

ASTRONOMY

As mentioned at the beginning of this report, the annual Survey of Enrollments and Degrees was expanded to include astronomy data in the mid-1970's but limited itself to the degree-granting astronomy departments, of which there are approximately 70. Thirty of them are combined physics and astronomy departments where difficulties of definition can arise when astronomy students are granted physics degrees and subsequently affect trend data.

The information presented in **Table XII** is similar in format to the physics data presented in **Table II**. The decrease in bachelor's degrees may be real or it may simply reflect 20 or 30 double majors who were included among the physics majors. The fluctuations in first-year graduate enrollment may also be attributable to the definitional problems mentioned earlier.

Table XII. Trend in astronomy enrollments and degrees, 1975-1984

Academic year	No. of astronomy degrees granted (July 1-June 30)				Undergraduate astronomy major enrollment		Graduate astronomy enrollment	
	Bachelor's	Master's enroute	Terminal master's	Doctor's	Juniors	Seniors	Total	1st year
1975-76	172	56	35	93	305	280	780	165
1976-77	184	58	35	96	290	270	790	170
1977-78	177	64	31	93	295	270	803	171
1978-79	165	42	42	90	270	249	710	145
1979-80	165	27	27	106	262	242	698	154
1980-81	156	34	24	82	275	238	686	164
1981-82	181	54	15	70	252	224	647	142
1982-83	138	61	22	81	274	232	670	178
1983-84					242	217	688	154

Table XIII. Astronomy* enrollments 1983-84 and degrees 1982-83 by type of institution**

	Type I	Type II	Type III	Total
Astronomy departments	Combined	17	2	11
	Separate	5	3	30
	Total	22	5	41
Astronomy degrees	Bachelor's	36	6	96
	Master's enroute	-	3	58
	Terminal master's	-	3	19
	Doctor's	-	-	81
Astronomy enrollments	Introd. courses for science majors	498	68	2 779
	Introd. courses for nonscie. majors	5 746	1 711	33 772
	Introd. astronomy courses offered in physics departments	-	-	-
	Total introductory enrollments			103 504
	Junior astronomy majors	51	19	172
	Senior astronomy majors	45	17	155
	First-year graduate students	-	9	145
	Total graduate enrollment	-	18	670
				688

*This survey includes only degree-granting astronomy departments.

**"Institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.

While there are comparatively few institutions that offer an astronomy major, introductory astronomy courses are a popular science requirement, and are offered in both physics and astronomy departments as shown in **Table XIII**. For purposes

of comparison with physics the 68 astronomy departments are divided into three groups on the basis of highest astronomy degree offered and their enrollments and degrees classified accordingly.



*Additional publications available from the Manpower
Statistics Division are:*

*Graduate Student Survey
Employment Survey
Survey of Physics and Astronomy
Bachelor's Degree Recipients*